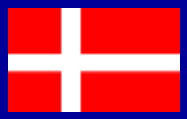
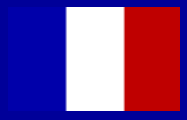
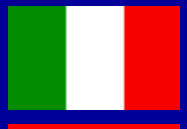


Reduced Sensitivity RDX
US and International Efforts

Presented by: Lori A. Nock
NSWC Indian Head Division

39th Annual Gun & Ammunition/Missiles & Rockets
Conference & Exhibition
13-16 April 2004

DoD POC: Dr. Ruth Doherty
NSWC Indian Head Division
301-744-6778

Reduced Sensitivity RDX *Background*

- In the late 1990s SNPE (SME now Eurenco) marketed an “insensitive” form of RDX (IRDX®)
  - Woolwich synthesis
  - Employed proprietary recrystallization process
  - Produced RDX that displayed reduced sensitivity to shock initiation as measured by Large Scale Gap Test
- In 2001 Army pursued an FCT program to evaluate IRDX® in 155 mm projectile with the goal to:
  - determine whether IRDX® would improve the IM characteristics of the projectile
  - determine whether the SNPE crystallization process could be implemented at Holston (Bachmann synthesis) to produce reduced sensitivity RDX

Reduced Sensitivity RDX
Results of FCT

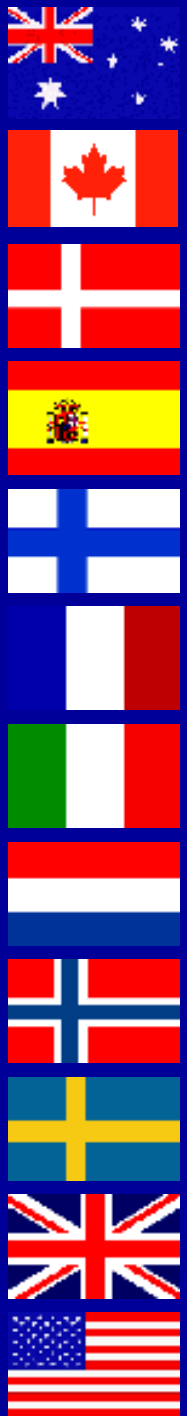
- SNPE
  - recrystallized HSAAP RDX into IRDX®
- US Army, Navy and AF
  - evaluated 2 formulations using both IRDX® and HSAAP IRDX®
    - Wax-based melt castable explosive (Air Force)
    - Cast curable PBX explosive (Navy)
  - conducted performance and IM testing
  - Upon aging, the HSAAP RDX recrystallized by SNPE did not retain the original “insensitive” characteristics

Reduced Sensitivity RDX
Post FCT

- Subsequently, other manufacturers claimed to produce forms of RDX that exhibit reduced sensitivity to shock relative to conventional RDX as produced by the Bachman process.
- In 2003, Army published a sources sought solicitation
  - Who makes it?
  - Analysis techniques (How do you know it's "Reduced Sensitivity RDX")
- The following manufacturers are now claiming to make Reduced Sensitivity RDX (RS-RDX):
  - EUROENCO (aka SNPE): IRDX®
  - Australian Defence Industries (ADI): Grade A RDX
  - Royal Ordnance Defence (RO): Type I RDX
  - Dyno Nobel: RS-RDX
- Of these, only Dyno employs the Bachman process.

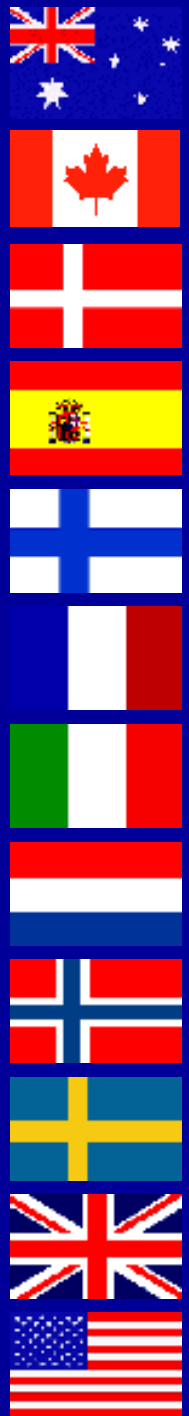
Reduced Sensitivity RDX
What makes RDX insensitive?

- No definitive explanation has been offered for the insensitivity of the RDX from these manufacturers.
- Crystal quality of some sort appears to be involved.
- No parameter that can be measured on the crystalline material has been identified that will enable one to distinguish between relatively more sensitive and relatively less sensitive forms.



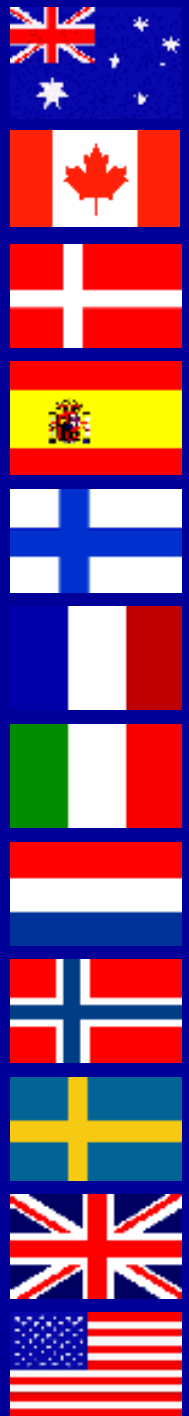
Reduced Sensitivity RDX
Current Efforts

- NIMIC Technical Meeting on RS-RDX held in Meppen, Germany in November 2003
  - Plans to update STANAG 4022 to address RS-RDX
  - Projected distribution for ratification: May 2006
- Supporting data for development of criteria for RS-RDX still needed
  - Round Robin testing of several kinds of RDX



Reduced Sensitivity RDX
Structure of Round Robin

- Step 1: Identification of techniques likely to show a difference between RS-RDX and non-RS-RDX
  - Done at NIMIC meeting in Meppen
- Step 2: Definition of methods to be applied to analysis
  - Protocol will be documented and all participating laboratories will follow same method.
  - Volunteers currently working on documentation
- Step 3: Procurement of RDX samples
- Step 4: Distribution of blind samples to participating labs
- Step 5: Experimental study of various kinds of RDX
  - Analysis of samples according to experimental protocols at all participating labs
  - Shock sensitivity testing of PBXN-109 formulated with each of the types of RDX being tested
- Step 6: Comparison of results of analyses with shock sensitivity tests



Reduced Sensitivity RDX
*Round Robin Participating Laboratories**

- Australia – DSTO
- Canada – DRDC/Valcartier
- Germany
  - WIWEB
  - WTD 91
- Italy - Mariperman
- Netherlands – TNO Prins Maurits Laboratory
- Switzerland - Armasuisse
- UK - QinetiQ
- US
  - AFRL/MNME
  - US Army TACOM ARDEC
  - US Army AMRDEC
  - NSWC/Indian Head Division
  - NAVAIR/Weapons Division

No response yet from
- France (ISL)

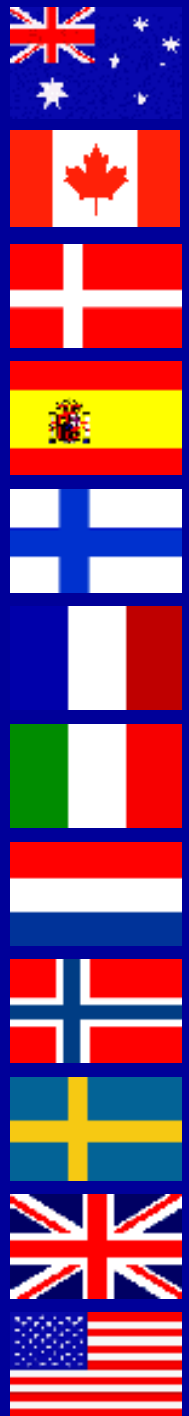
*Contingent on availability of funding

Reduced Sensitivity RDX Round Robin

Materials to be studied

- All samples will be commercially available material meeting US MIL-DTL-398D Class 1 granulation requirement

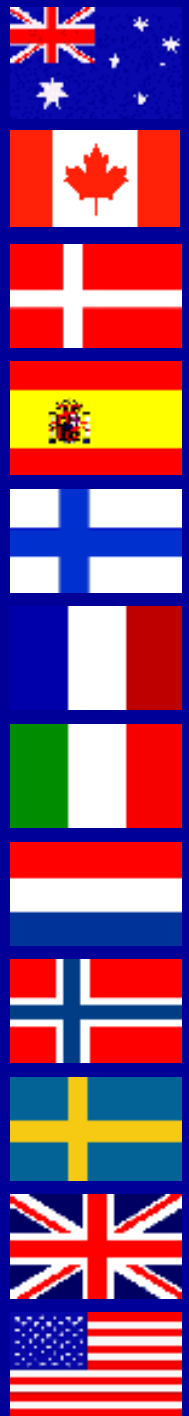
Source	Type	Process		HMX Content		Quality	
		Bachman	Woolwich	>5%	< 0.5%	RS-RDX	non-RS-RDX
OSI/Holston	Type II	X		X			X
Dyno	Type II	X		X			X
	RS-RDX	X			X	X	
ADI	Grade A		X		X	X	
SME	IRDX		X		X	X	
	MI-RDX		X		X		X
RO/Bridgwater	Type I		X		X	?	



Reduced Sensitivity RDX Round Robin *Analytical Methods for Neat RDX*

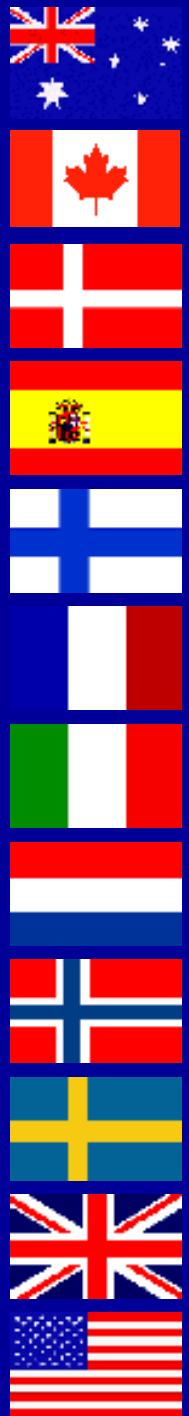
- Impurities (HPLC, GC)
  - HMX
  - Minor byproducts of synthesis
  - Solvents or other volatile organic compounds
- Melting point
- Impact sensitivity
- Vacuum thermal stability
- Particle size distribution
- Average particle density
- Particle density distribution
- Examination by optical and scanning electron microscopy
- Nuclear Quadrupole Resonance

STANAG REQUIREMENT



Reduced Sensitivity RDX Round Robin *Test Methods for Formulated RDX*

- Test: LSGT or ELSGT
- Formulation: PBXN-109
  - Widely used, so large amount of archival data
  - Much of the data on RS-RDX to date is in this formulation
- Aging will also be done to determine persistence of the effect
  - 6 months
  - Shock sensitivity testing at 2, 4, 6 months



Reduced Sensitivity RDX Round Robin *Status*

- 13 labs expressed interest in participating
- Analytical protocols being documented
- Source of US funding for RDX identified
  - Procurement actions ongoing
  - Possible delivery in 4th Qtr FY04
- Funding for characterization of most RDX samples at a Navy lab identified
  - Leveraging Navy Combat Safe Insensitive Munitions program.